SCIENCE EDUCATION IN THE SERVICE OF BRIDGING THE ISRAELI-PALESTINIAN DISPUTE OVER WATER RESOURCES

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Abstract – *In 1994 an educational program aimed at changing prevailing attitudes to favor peace and coexistence in the region was launched in the Israeli educational system. The program focused on the crucial conflict over water resources between Israel and its neighboring Arab countries – an issue at the heart of the Israeli-Arab conflict. The rationale of the educational program was based on cognitive approaches to attitudinal change and conflict termination, assumption being that providing relevant, 'major' information (Shamir and Shamir, 1996) would prompt the restructuring of existing salient beliefs regarding peace and cooperation and later the formation of attitudes in favor of them. A comprehensive curriculum focusing on water management issues was constructed and implemented in teachers colleges and schools. Findings from an evaluation study that followed the implementation of the curriculum showed large knowledge gains but only minor attitudinal changes, disappointing findings that led to the consideration of an alternative model to attitudinal change, incorporating a value component. In the new model, which evolved from Fishbein and Ajzen's (1975) theory of 'reasoned action', values function as mediating components between beliefs and attitudes. Learning activities aimed at decision-making in relevant dilemmatic situations enabled the learners to become aware of the values that govern their decision-making and allowed them to critically assess their views and attitudes. In light of these findings some thoughts on the future of this evolving project conclude the paper.*

Introduction

In 1993, after the signing of the Oslo Agreement and in the wake of the peace treaty with Jordan, it became clear to policy makers in Israel that moving from war to peace cannot be achieved by political actions alone but also requires public legitimization of the consequences of peace. At that time a monthly public opinion survey called the Peace Index Survey (Yochtman-Yaar, Harman and Nadler, 1996) revealed only moderate (50%-60%) percentages of people supporting the different

peace plans that were initiated. Many agents, amongst them the educational system, were recruited to bridge the discrepancy between policy decisions toward peace and public readiness for it. Amnon Rubinstein, the then Minister of Education, wrote:

> 'We should present the goal of attaining peace with our neighbors as a national aim and explain its vital importance, its contribution to the security and prosperity of Israel. However, we should also present the variety of opinions and the legitimate debate concerning the political agreement needed.'
>
> (Special Circular No. 14, May 1994, pp. 7, 8)

The following year, 1994, was officially announced as the 'Year of Peace', dedicated to curricular activities related explicitly to the Palestinian-Israeli conflict and to the peace process in all schools.

As part of this general orientation of the Israeli educational system to prepare youngsters to live in an era of peace, and in response to the minister's call, a small-scale educational program aiming to change prevailing beliefs and attitudes among Israeli youngsters to favor peace and coexistence in the region was initiated at the department of science at the Kibbutzim College of Education, Tel Aviv.

The conflict over water resources between Israel and its neighboring Arab countries was chosen to represent the Arab-Israeli conflict. A curriculum, centered on this issue, with scientific, technological, societal and political content in line with an STS – Science Technology and Society approach (Fensham, 1992) was developed and taught to student teachers in the science department at the college. Later the student teachers carried out this same program in junior high schools as part of their student teaching duties. This small project grew into a larger collaborative project between Israeli and Palestinian researchers and educators who shared the hope of ending the dispute between Jews and Arabs living in the region. The collaborative project undertaken in 1995, was supported by the Netherlands-Israeli Research Program (NIRP). A joint educational program was planned and executed in an experimental sample of junior high schools in the Palestinian Authority and in several teachers colleges and junior high schools in Israel. In Israel this curriculum gained the recognition of the Ministry of Education and was published. Since 1999 it has become one of the official peace curricula taught tin junior high school.

The joint educational program was guided by cognitive approaches to attitudinal change and conflict termination. Early on in the program it was found that although the participants held strong beliefs regarding the water dispute, these were not backed by evidence. It was assumed that providing relevant information

of a 'major' nature (Shamir and Shamir, 1996) on the issues would lead to the restructuring of existing salient beliefs regarding peace and cooperation and, later on, the formation of attitudes in favor of these.

This paper is dedicated to describing the Israeli curriculum 'Water in an Era of Peace', which constitutes the core of the educational program on the Israeli side. The paper will present the cognitive approach to attitudinal change and to conflict termination that form the base of this curriculum and the limitations of such an approach. Since an evaluation study that followed the implementation of the curriculum showed only minor attitudinal change in the desired direction, a new curriculum based on a more comprehensive approach to attitudinal change was developed and trialed. We will describe how this alternative approach evolved and illustrate the nature of the two types of curricula that stemmed from each of the approaches.

We will start with a short introduction on the nature of conflict relating it to the conflict over water resources in the Middle East – the main issue in our peace curricula. This introduction is then used to justify the cognitive approach applied in our first curriculum. A typical learning activity will demonstrate this. Findings from the evaluation study carried out while implementing the curriculum, and conclusions drawn from them, are used in elaborating on the extended new approach. Here too, a typical learning activity that illustrates the second curriculum is presented. In light of some experimental results from trying the second curriculum, some thoughts on the future of our evolving project will conclude this paper.

Conflict emergence, development and termination

An important distinction between *realistic* versus *unrealistic* conflict (Coser, 1956) directed us to a cognitive approach to peace education. *Realistic conflicts* stem from opposed interests between two parties which may have negative relationships of two types: dominance or competitiveness over rare resources such as land, water, etc. (Campbell, 1965; Levine and Campbell, 1972). *Unrealistic conflicts* are mainly regarded as a psychological response to frustration and fear. In such cases, there is a *perceived* conflict of interest that is not necessarily realistic. Generally, realistic and unrealistic conflicts occur intertwined to varying degrees. Levine and Campbell (1972) describe the web of psychological responses that may escalate a realistic conflict into an unrealistic one as follows:

> 'At the basis of realistic conflict, there is a real conflict of interest that causes real threat. Real threat causes hostility to the source of threat as well as solidarity within the ingroup. This solidarity

> leads to own ingroup identity and ultimately an increase in ethnocentrism. Increased ethnocentrism can lead to escalation of the conflict.' (pp. 29-42)

Orr (1995), referring to a comprehensive model of conflict (Fischer, 1990), offers a full description of the emergence, evolvement and resolution of intergroup conflict which also demonstrates the intertwining of realistic and non-realistic elements:

1. Intergroup conflicts usually begin with a real conflict of concrete interests; a negative dependency of aims exists, i.e., attainment of one side's aims is negatively correlated with the attainment of the other side's aims and competitive orientation and interaction emerge (zero-sum thinking).
2. In real conflict, cultural differences and a history of conflicts create a perceived threat.
3. Perceived threat causes ethnocentrism which further causes ingroup solidarity on the one hand and intergroup hostility on the other.
4. Ethnocentrism decreases the level of trust between the parties involved.
5. Where communication is inefficient, interaction is competitive; feelings of threat, mistrust and ethnocentrism intensify the conflict.

When talking in terms not of socio-psychological processes, but, rather, of epistemic structures (Bar-Tal, Kruglanski and Klar, 1989) conflicts can be regarded as cognitive schemes, mental representations of knowledge, the content of which refers to the incompatibility of goals between parties. In line with this notion of conflict, Bar-Tal and his colleagues (1989) talk about *conflict resolution* which requires epistemic restructuring or the replacing of a conflict scheme with an alternative one, for instance, compromise. In all frameworks described, conflict is always characterized by realistic incompatible interests of the two parties involved. It is beyond the scope of any educational intervention to deal with these. All that is left for educators to do is to deal with the unrealistic elements of the conflict – fear, mistrust, ethnocentrism and above all, the perceived beliefs of incompatibility of aims and the zero-sum way of thinking. It should be noted that although the discourse on conflict within the epistemic and the socio-psychological framework is different, the essence of termination of the two types of conflict remains the same. According to both approaches, conflict termination seems to be dependent on processing new information, forming new beliefs and attitudes or changing existing conflict schemata. Thus, in the following section we will deal with definitions of beliefs and attitudes and with mechanisms of forming and changing them.

Definitions of attitudes and beliefs and mechanisms of formation and change

Attitudes have long been an object of research, yet there is no accepted definition (Olsen and Zenna, 1993). Several elements tend to reappear in the various extant definitions. First, there is the evaluative nature of attitudes – a psychological tendency to evaluate an object with some degree of favor or disfavor (Eagley and Chaiken, 1992; Zanna and Rempel, 1988). Second is the knowledge structures which support the evaluate stance a person holds (Fazio, 1990; Kruglanski, 1989; Pratkanis and Greenwald, 1989). Some definitions center on the affective dimension: Bem (1970) argued that 'attitudes are our likes and dislikes' (p. 14), while Greenwald (1989) defined attitudes as 'the affect associated with a mental object' (p. 432). Lastly, in some cases, attitudes are regarded as a pre-disposition to act, e.g, mental state of a person who has a favorable or unfavorable intention to act toward an object, person or idea (Triandis, 1991), or as learned dispositions to consistently respond favorably or unfavorably toward an object (Ajzen and Fishbein, 1977, 1980; Fishbein and Ajzen, 1975). In that line of thinking, McNaughton (1998) regards attitudes as the motivational push that drives an agent to act.

Fishbein and Ajzen (1975) made an important distinction between attitudes and beliefs and in doing so succeeded in uniting the different elements that appear in the definitions of attitudes. According to them, whereas attitudes refer to a person's favorable or unfavorable feelings (affect) toward an object, beliefs link this object to specific attributes (knowledge) of the object. The more probable the association between the object and its attribute, the stronger the belief. This probability is, of course, experienced subjectively.

Beliefs may be formed as a result of direct observation, through self-generated inferences, or it may be indirectly formed by accepting information from such outside sources as friends, media, etc. (Ajzen, 1988, p. 33). Beliefs can be descriptive ('I believe the attitude of the object to be true or false'), evaluative ('I believe the attributes of the object to be good or bad') or prescriptive ('I believe the attributes of the object to be desirable') (Rokeach, 1968, p. 124).

Attitudes are a set of beliefs interrelated around a common object or situation, concrete or abstract. In terms of the theory of Reasoned Action (Ajzen and Fishbein, 1977), attitudes follow reasonably from beliefs people hold about the object of the attitudes, just as intentions and actions follow reasonably from attitudes. Although a person may hold a large number of beliefs it appears that only a relatively small number of them play a role in attitude formation – these are called *salient beliefs*. The totality of salient beliefs multiplied by the strength of these beliefs serves as the informational base that ultimately determines our

attitudes and behaviors. Rokeach (1968) distinguished also between *core beliefs* and *peripheral beliefs*. Core beliefs are more important and therefore more resistant to change. Peripheral beliefs, those that are less important to the individual, are connected with the core beliefs forming a beliefs' structure. McGuire (1985) suggested when they form attitudes and make decisions people often consider just one salient attribute of an attitude object, presumably the most important attribute.

An input of relevant information, whether based on personal experience or on outside sources (such as media, books, or other persons), and structuring the ways in which this information is processed, is regarded as the basis for forming or altering beliefs and, ultimately, attitudes.

Two mechanisms of information processing: persuasion and epistemic restructuring, were used as part of an educational program. Persuasion is defined as a 'conscious attempt to bring about a jointly developed mental state common to both source and receiver, through the use of symbolic cues' (Koballa, 1992). Persuasion is considered successful when a belief or an attitude change is grounded on considerations perceived as convincing by the recipient.

Two leading groups of researchers on persuasion processes are Petty and Cacioppo (1981, 1986), with their *elaboration likelihood model,* and Chaiken (1987) and Chaiken, Lieberman and Eagley (1989), with their *heuristic-systemic model*. In both models, individuals are assumed to process a persuasive message carefully when they are motivated and able to do so. When the arguments in the message processed are strong and the information is relevant, persuasion occurs and consequently beliefs and attitudes are formed or altered.

The other mechanism of information processing view attitudinal change through an alternative theory, the *lay epistemic theory* (Kruglanski, 1980a,b; 1989). Here, the process of belief/attitude formation is described as a process of restructuring existing cognitive schemes (beliefs or attitudes). This process contains two phases: the *generation phase*, when information is stored in knowledge structures, and the *validation phase*, when the individual tests the generated cognitive structures or their implications against the evidence s/he possesses. The more consistent the two, the more confident the individual will be in holding a belief. In both mechanisms of attitudinal change described above the processing of information plays an important role and humans are viewed as rational, knowledgeable organisms who use information to form and evaluate their beliefs, make judgments, decisions, and build their attitudes. This view led us to decide upon the nature of the educational intervention needed for our purpose.

TABLE 1: An Exemplary Activity: Water in an Era of Peace

Conflict Related to International Water Resources

Students are invited to study the problematic aspect of using shared water resources, the international treaties and principles employed in settling disputes over international water sources, their benefits and shortcomings.

First Activity

- Read definitions of international water resources and determine which of the water resources in Israel (surface and ground water) fit these definitions.
- Study international laws and principles concerning rights and allocation of international water sources: the Helsinki Treaty (1966); the 21st Century Agenda (1992), and the Bahrain Agreement (1993).

In light of these documents, study the peace treaty between Israel and the Hashemite Kingdom (1995), especially those sections related to water agreements, and compare the international principles on rights and allocation of water to the relevant items in the Israeli-Jordanian document.

Second Activity

A case study: Applying international law to the problematic issues concerning the Yarmuk river – a river that crosses Syria, Jordan and Israel.

- Studying the geographical and hydrological characteristics of the Yarmuk river.
- Reading a set of abstracts from Israeli newspapers related to the issue of managing the Yarmuk river water. Establish your own opinion on the issue.

Third Activity

A Simulation Game

Groups of nine participants, each representing one Middle East country, and additional UN representatives are chosen to negotiate water treaties. Each of the participants has to represent the interest of his/her Middle East country – using the material studied during the project and additional sources – each group appears at the negotiating table with their own flag, costume and other symbols of national identity.

The game aims to achieve as many as possible water arrangements among the countries – both bilateral and multilateral. Each agreed upon arrangement scores a point. Success depends on knowing the facts about the country represented (economic, political, natural resources, population, etc.), the ability to convince and persuade in a polite manner, rhetorical skills and listening skills.

The rationale and characteristics of the educational intervention

In light of the above described 'information processing' models, a science curriculum that represented an integrated approach in science education was developed by the project team. Focusing on the water conflict in the Middle East, and especially on that part of it that had bearing on both Israelis and Palestinians, the curriculum offered information on the following topics: water as a global resource; water sources and systems in the region; groundwater, main aquifers, technologies for using groundwater, water uses and users; factors affecting availability and consumption of water; water balance of the countries in the region; technological, behavioral, economic, legal and political solutions to water scarcity.

In providing the above information, the curriculum tried to persuade (rather than to indoctrinate) that the solution to the water conflict between Israelis and Palestinians lies in cooperation and in compromises on both sides. An illustration of some activities from the Israeli curriculum will bear this out (see example on previous page).

Results of the first educational intervention and the move from the 'information processing' model to the 'value laden' model

The implementation of the curriculum was followed by an evaluation study, which came mainly to assess the effect of the educational programs on participants' initial knowledge base and to estimate the impact of their knowledge change on attitudes. Findings from this evaluation study showed large knowledge gains but only minor attitudinal changes in the desired direction, examples of which would be: an increase in the willingness to act for the sake of peace and increased recognition that, without solving the water problem, there will be no peace; Increase in the groups' interest in joint management of water resources and weakening of separatist – territorial, views regarding water. (For further reading see Zuzovsky, 2000; Haddad, Zuzovsky and Yakir, 2000.) Unexpectedly, a significant negative association appeared between knowledge gains and attitudes in favor of peace, especially among Jewish student teachers. Since this was also the group with the highest knowledge gain score, it is clear that gain in knowledge alone does not necessarily lead to the formation of beliefs and attitudes in favor of peace.

In looking for explanations for these disappointing results it was assumed by us that the minor change in beliefs and attitudes is related to the nature of the information processed. It was found (Bar-Tal, 1991; Binyamini, 1994; Shamir

and Shamir, 1996) that when information is ambiguous, i.e., open to several interpretations, individuals do not necessarily encode all of it. Instead, they may assimilate only those parts that are congruent with their already existing beliefs and value systems. In their study on value preferences in the Israeli public opinion, Shamir and Shamir (1996) point to the central position of both the peace value and the security value held in the minds of the Israeli public. Positive attitudes toward peace are always accompanied by feelings of fear alongside feelings of hope, creating substantial ambivalence in regard to the peace process (Bar-Tal, 1991). When peace and security are closely intertwined in people's thoughts, they will be reluctant to go for peace. In the case of our educational program, information provided in the course of it, although relevant and direct, was complex and could be interpreted differently in light of already existing but conflicting deep beliefs: in favor of peace on the one hand and in favor of security on the other.

In another study carried out on civic and political attitudes of Israeli Jewish youngsters (Binyamini, 1994), high school pupils were found to be even more ambivalent toward peace than adults (Arian, 1994). High levels of reluctancy vis-à-vis peace were found among youngsters of low socio-economic groups and religious backgrounds. Even though these youngsters showed a general readiness for compromise and territorial concessions, on specific issues (like withdrawing from the Golan Heights [occupied Syrian territory] or compromising on water resources), they were less willing to compromise. Binyamini relates this finding to the security values and beliefs imprinted on the collective consciousness of Israeli society as a whole.

It has become clear to us that providing information solely does not guarantee attitudinal change. If we want to shape attitudes through cognitive mechanisms, the deep and enduring beliefs usually referred to as values should first be dealt with. This led us to develop our second model of attitudinal change, which already included an affective-evaluative factor.

Values and the role they play in forming and changing attitudes and behavioral intentions

The definition of values is based on the definition of more basic terms, i.e., beliefs and attitudes which were previously discussed. A common feature of beliefs, attitudes and values is their hierarchical, organizational nature. This organization is hierarchical in terms of relevancy or importance. Thus some beliefs are more salient than others and some attitudes and values are more important than others. One way of representing this hierarchy is by using a

concentric representation with core beliefs, attitudes or values in the center of the relevant system. The more central the beliefs, attitudes and values, the more resistant to change they will be.

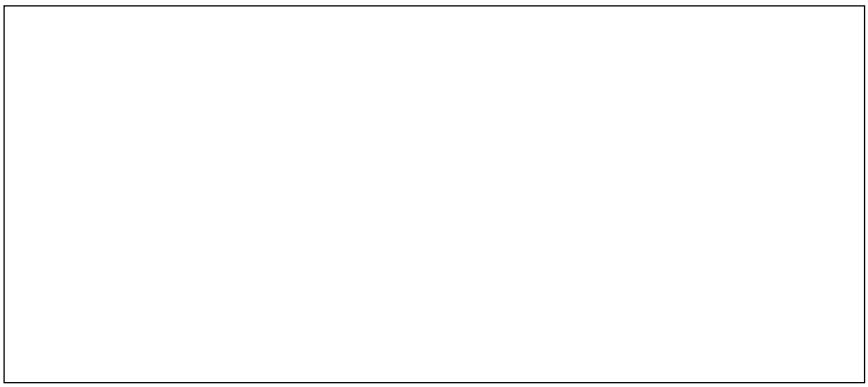
An attempt has been made to associate values with human needs: biological, social or societal (Schwarz, 1996; Schwarz and Bilski, 1987). Those adhering to this view assume that values function like needs to influence goal-directed behavior (Feather, 1995). In contrast to this view, Leibowitz (1985, 1968) claims that values are beyond human needs and indeed antithetical to them. He argues that in linking values to human needs, we erroneously assume that values have a causal foundation in physical or psychological reality. However, no-one *needs* to be honest, or brave, or committed to his homeland, etc. Values are measured not by what people gain from adhering to them, but rather by what they are ready to sacrifice for them.

Values are shaped and learned through experience. Once a value is internalized it becomes, consciously or unconsciously, a standard or criterion for: (i) developing and maintaining attitudes toward relevant objects and situations, (ii) justifying one's own and others' actions and attitudes, (iii) morally judging self and others, and (iv) comparing self with others.

> 'Once values are internalized, they become consciously or unconsciously a standard or criterion for guiding action and maintaining attitudes toward relevant objects and situations, for justifying one's own and others' actions and attitudes, for morally judging self and others and for comparing self with others.' (Rokeach, 1968, p. 160)

Given the role values play in shaping attitudes and behavior we integrated a value component within the theory of Reasoned Action (Fischbein and Ajzen, 1975). According to this theory, two kinds of salient beliefs intertwine in the formation of attitudes and norms that then affect the intention to perform a certain behavior: *personal* and *social beliefs*. *Personal beliefs* reflect the extent to which one believes that engaging in a certain behavior will lead to a favorable outcome. *Social beliefs* reflect normative beliefs about the worth of a specific behavior. These beliefs create attitudes and social pressure to perform, or not to perform, the behavior (subjective norm concerning the behavior). In the new 'value laden' model, values play a mediating role in these processes. They affect the conversion of *personal beliefs* into attitudes and the conversion of *social beliefs* into subjective norms. They are also involved in turning attitudes and subjective norms into intentions to act and then into action itself. Figure 1 represents the place of values in the model of Reasoned Action.

FIGURE 1: Integration of values within the theory of reasoned action



This new model grants the values individuals hold before starting the educational program special power in processing information provided during the educational intervention. In designing an educational intervention, the values participants hold cannot be ignored. They should be highlighted and should themselves become the target of the educational program.

Rokeach's early work on values (1973) was used to identify participants' existing values. He defined and described 56 single values which were later classified by Schwartz and Bilsky (1987) into ten types: power (control), achievement, hedonism, stimulation, self-direction, universalism, benevolence, conformity, tradition, and security. As will be shown, three of these ten types are relevant to the conflict that was the focus of our program. *Power,* which represents control or dominance over people and resources, and *security,* representing safety and harmony of society. These two values are complementary and they both contradict the third type – *universalism,* which represents the desire to understand, appreciate, tolerate and protect all people and nature, or, in the terminology of the conflict at hand: the desire for peace.

Usually people are unaware of the values that govern the way they process information and construct their attitudes and behavior. This prevents them from considering their commitment to these values. Such an awareness can be gained when values are activated. According to Schwartz, 'it is in the presence of conflict that values are likely to be activated, to enter awareness, and to be used as guiding principles.' On this assumption, we decided to expose the values individuals hold by engaging them in a decision-making situation concerning a controversial dilemma related to the Israeli-Palestinian water conflict. Here is a brief description of this dilemma and the conflicting values that arise in making a decision in this matter.

The dilemma of the mountain aquifer

The mountain aquifer underneath the West Bank (Palestinian authority) is the major source of water serving both sides– Israelis and the Palestinians. It is an artesian aquifer that most of whose recharge area lies beneath the West Bank while its natural subterranean flow is toward Israel, where most of the springs and wells are located (Becker and Zeituni, 1998; Feitelson and Haddad, 1998; Gvirzman, 1994). Currently, this aquifer provides approximately 35% of Israel's annual fresh water consumption and virtually all the fresh water consumed by Palestinians on the West Bank. The total annual recharge of the mountain aquifer is estimated at 680 mm^3/year. Of this, Israel uses approximately 480 mm^3/year, and the Palestinians' draw is variously estimated at 110-180 mm^3/year (Kliot and Shemueli, 1998). The conflict is further complicated by the unequal per capita water consumption of the two sides. Palestinian per capita annual water consumption is less than a third of equivalent Israeli per capita consumption. High rates of population growth and forecasts of increased water consumption on the Palestinian side, the fact that all feasible freshwater sources are already being used, and the rapid development on the land covering the aquifer recharge areas (Feitelson and Haddad, 1998) only accelerate the problem.

Israelis argue that the water rights over this aquifer should be determined according to historical use of the water for over 50 years. Palestinians, on the other hand, argue that water rights over this aquifer should be determined according to territorial boundaries of the recharge area of the mountain aquifer. As it is situated in Palestinian territory, the water in the aquifer belongs to them (Gvirzman, 1994).

Ownership of the mountain aquifer water resources is, hence, not a settled matter. A possible solution to this conflict is to acknowledge the rights of both sides and to share the water.

Taking into consideration the information provided on this issue, participants were asked to come to a decision whether or not to share the water of the mountain aquifer with the Palestinians for the sake of peace. This creates a dilemma for the audience of the educational program.

The Oxford English dictionary defines a dilemma as a choice between two (or, loosely, several) alternatives which are or appear equally unfavorable. Lampert (1985) extends this definition to include choice 'between equally undesirable alternatives of action…' or 'between opposing tendencies within oneself' or 'between equally important but conflicting aims' (pp. 179, 182). She argues that as there is no 'right' alternative of action such choices are often not rationally decided. This view is supported also by Billig, Condor, Edwards, Gane, Middleton and Radley (1988) who claim that choice in a dilemma is not technical, but rather value-laden and that the conflicting values underlying dilemmas are

fundamentally borne out of a culture which produces more than one possible ideal world (p. 163). As such, dilemmas can be used to elicit a person's conflicting values. This type of activity became the core of the second education intervention which focused on several dilemmas that required decision-making (Dressler, 2002).

An exemplary activity and the rationale of the second educational intervention

In this section we will illustrate and explain a model of eliciting the values inherent in the process of making decisions in dilemmatic situations (see example). This intervention follows seven stages of a decision-making model (Beyth Marom, 1991) described below:

Stage 1: Introduction. The mountain aquifer dilemma was presented in the context of water scarcity in Israel and neighboring countries and after dealing with the hydrological aspects of water management. Next, two alternative courses of action (to share the water or not to share) were offered to the students and they were asked to choose the one they prefer most and to state arguments for their choice.

Stage 2: Developing Criteria. At this stage suitable criteria for comparing the two courses of action were developed by using a consequence map strategy (Fullick and Ratcliffe, 1996). This strategy encourages students to think of the broadest possible range of consequences while considering the implications of each course of action. The question posed to the students was: What are the possible consequences of sharing (or of not sharing) the mountain aquifer water with the Palestinians for the sake of peace? Consequence maps were constructed by groups of students. As a result of the discussion following the construction of these maps, synthesis of these varying maps was carried out on the blackboard. Figure 2 presents an example of a class map reflecting the interpretation and understanding of both teacher and the students.

The key consequences i.e., the ones most students and teachers mentioned were classified according to their implications: ecological, political, health, economic, and security implications. These consequences were used as criteria for comparing the two alternative courses of action.

Stage 3: Gaining Information. At this stage students backed their consequence map with further information and clarified what was already known about each alternative with particular reference to the criteria just developed. The students

Decision-Making Activity

To share or not to share the mountain aquifer water for the sake of peace?

In the following activity you are going to experience a decision-making process on a controversial issue that engages the Israeli public: To share or not to share the mountain aquifer with the Palestinians.

1. Choose one of the following courses of action: (1) to share the water, (2) not to share the water. Back your decisions with thoughtful arguments.
2. Try and detail all possible answers to the following questions: What will be the consequences of sharing (or of not sharing) the mountain aquifer with the Palestinians for the sake of peace? Draw a 'consequences map' that reflects chains of consequences and interconnections between them.
3. Introduce your group's consequences map to the class for a discussion and with the aim of creating a class consequences map.
4. Classify the types of consequences into key-categories. These will serve you for analyzing the advantages and disadvantages of choosing each course of action.
5. Gather relevant information about each course of action with particular reference to the criteria just developed.
6. Organize the relevant collected information in the following table:

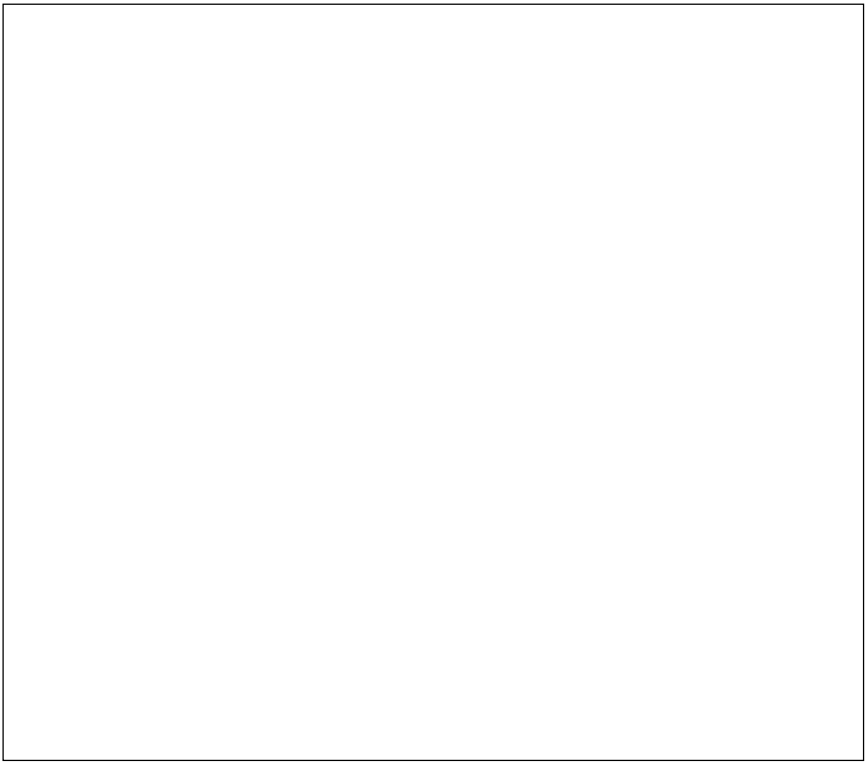
Alternatives **Criteria**	**To share**	**Pro or Con**	**Not to share**	**Pro or Con**

7. State a choice that is based on the analysis undertaken in the previous stage. Back your decisions with thoughtful arguments relying on valid information.

were encouraged to gather information from any source they could think of. In addition, they were given some informative texts as a stimulus and hint for possible directions in their data search.

Stage 4: Organizing Data and Judgment. The students organized relevant information that was collected in a two-dimensional matrix of alternatives vis-à-vis criteria (see table in the work sheet presented). This allowed cross-evaluation of each alternative on each criterion. Every criterion was judged with respect to

FIGURE 2: Class consequence map



the alternative courses of action by identifying its advantages or disadvantages (pro or con).

Stage 5: Stating Choice. On the basis of the analysis undertaken, the students chose their preferred alternative without assigning weights[1] to the utility of the various courses of action and the probabilities of their occurrence. Engaging students with the above calculation is technical and could redirect students away from value consideration. After making their decision the students were asked to propose as many arguments as they could think of in support of their choice.

Stage 6: Raising Arguments for their Choice. Argumentation gives students an opportunity to reflect on the process they have gone through: Consider relevant evidence, re-evaluate their judgment and choice and come to reasoned conclusions

about the chosen alternative. In this stage the students were asked to raise as many arguments as they could think of to support their choice.

Stage 7: Reflection. Each group of students was asked to present their work to the class and to reflect on the process they went through while choosing their course of action. The presentation also served as a trigger for reflection for other members of the class.

Results of the second educational intervention

The second educational intervention was carried out on three groups: students in non-religious Jewish schools, students in religious Jewish schools and students' schools for Arab citizens of Israel. We hoped that with the elaborated decision-making mechanism, would enable us not only to expose the values that govern participants' decisions, but also to make them change their prior decisions in light of this complex process. The results of such an experimental intervention were, again, quite disappointing. Only about one quarter of the participants changed their earlier decisions and only 15% out of them changed their decisions from not favoring the sharing of water to favoring it (for further reading, see Dressler, 2002). Underlying these decisions were of course, deeply embedded values. We tried to elicit these values by analyzing arguments the participants used in defending their decisions.

Here follows a brief description of the results: it consists of examples of common arguments given by the students and the corresponding, extracted values:

Arguments used by the stable in favor groups

Jewish and Arab Israeli Students

- We must give them water in order to promote peace. *Universalism*
- Arabs and Israelis are equal human beings, it is impossible not to give water to thirsty people, we must think also about the others. *Universalism*
- If we do not share the water, the next war will be the 'water war'. *National security*
- Sharing water will create more opportunities for industrial development. *Economic security*

Arguments used by the stable against groups

Secular Jewish

• Water sharing will have negative effects on security	*National security*
• Palestinians are never satisfied with what they perceive as a result of peace treaties and always demand more and more	*National security*
• Sharing water with the Palestinians may damage the environment.	*Universalism*
• A peace treaty will not avoid terrorism; enemies will continue attacking us.	*National security*
• It is most important that we have full control over the mountain aquifer.	*Power (control)*
• Water sharing will have negative effects on the economy.	*Economic security*

Religious Jewish

• If we give them a finger they will want the whole hand	*Power (control)*
• The mountain aquifer is part of Greater Israel	*Power (control)*
• Israel is the promised land, no-one can take this land from us	*Power (control)*

Arab Students

• We prefer not having a peace treaty to dying form water scarcity	*Personal security*
• Sharing water will cause great shortage of water and therefore agriculture will be reduced and affect our standard of living.	*Personal security*

Observing the consistency of the values that underlay the arguments of three-quarters of the participants, it became clear to us that the strategy used in our second educational intervention was not effective. When facing a decision-making situation which involves two conflicting values such as peace (a universal value) versus security or power control values, participants tend to store and

encode information in line with those values that are more central to their value system. Thus, those who were already convinced by the advantages of sharing the mountain aquifer with the Palestinians for the sake of peace, kept raising arguments that were based on universal types of values and on arguments that linked their decision to national security and economic prosperity; those, on the other hand, who from the outset were against sharing the water sources came up with arguments based mostly on power control (religious Jewish) or on personal security values (Arab students).

The cognitive approach failed for the second time in altering beliefs, attitudes and the values underlying them. In an attempt to understand what went wrong, we went back to Milton Rokeach's studies and his theory of value organization and change. According to this theory, long-range changes in values, attitudes and behavior are possible. They result from an objective feedback of information about one's own and others' values and attitudes. Rokeach presents evidence that such feedback made many participants conscious of certain contradictions in their own value-attitude system.

There was also evidence in Rokeach's work that the basic psychological mechanism responsible for value or attitudinal change was a state of self-dissatisfaction. This self-dissatisfaction occurred when a person gained awareness that certain of his or her values, attitudes or behaviors clash with or violate her or his self-conception as a moral human being. A person must then reorganize her/his value-attitude systems to make it more consistent with their self-conception (Rokeach, 1973, Rokeach and Grube, 1979, p. 242). An easily applied cognitive and behavioral change technique called 'self-confrontation' has been developed from this theory. This treatment is designed to provide individuals with information that will lead to awareness of chronic inconsistencies within their value system and their self-conception.

According to Rokeach, value education in schools should go in this direction. It should attempt to provide substantive information about the student's own values and about the values of others in their society in order to encourage students to compare what they find out about others with what they have found out about themselves. Such value education would encourage what John Dewey has called the experience of a 'felt difficulty' – a basic condition of learning and change and also a basic condition for realization of what are perhaps the ultimate educational values – individual growth and self-realization (Rokeach, 1979, p. 269). Value change thus is considered a long-term change tied to the process of education and re-education (Rokeach, 1968).

Reflecting on the step-by-step strategy we employed in our second intervention, we realized that it did not fulfill Rokeach's suggestions for self-confrontation. The strategy we used enabled us, as researchers, to map and

understand the values underlying individuals' decision-making and justifications. We even noticed contradictions and inconsistencies within participants' value systems. However, this knowledge was not shared with the students, i.e., they were allowed to remain unaware of these inner contradictions. The missing step is still ahead of us in planning what Rokeach calls a *self-confrontative tactic*. This will be the next stage of our project.

Science education in the service of peace education

In this paper we described a more than seven-years project of peace education carried out mostly by science teachers. This is an instance of the Science Technology and Society (STS) approach in science education. In the final section, we would like to sum up our experience in teaching science as an integrated subject area and as a means of educating youngsters to be informed and responsible citizens, one of the most important goals of the STS approach.

Most STS-based curricula emphasize two interconnected domains: the *cognitive domain* (beliefs, attitudes, values), which refers to gaining knowledge and understanding on the interaction of science, technology, and society (Bybee, 1997; Ramsey, 1993; Yager and Tamir, 1993), and the *behavioral domain* which refers to developing social responsibility – active personal and social decision-making (Miller, 1983; Rubba, 1990). Rubba (1990) stated that the goal of STS education is to help students develop the knowledge skills, and affective qualities they need to take responsible action on the many social issues facing humankind. Hodson (1999) argued that it is not enough for students to learn that science and technology are influenced by social, political, and economic forces. They must also learn how to participate in real situations that require the use of the scientific and technological literacy needed for social and politically responsible actions.

Scientific and technological literacy has been defined in several ways, from grasping basic information and concepts needed to thrive in the modern world (Hirsch, 1987) through understanding the impact of science and technology on society, and finally, gaining the ability to act in a socially responsible way (Eisehart, Finkel and Marion, 1996; Miller, 1983). This ability to use knowledge in one's actions involves, according to Eisenhart et al. (a) understanding of how science-related actions impact the individuals who engage in them; (b) understanding the impact of decisions on others, the environment and the future; (c) understanding the relevant science content and methods, and (d) understanding the advantages and limitations of scientific approach. All these would be indicators of socially responsible scientific literacy (Eisenhart *et al*., 1996, p. 284).

If this type of scientific literacy becomes the main goal of science education today then owing scientific knowledge becomes the basis for developing self-efficacy and for individual empowerment (Hungerford and Volk, 1990) or as Sylvia Scribner termed it, *ideal literacy,* referring to the 'simultaneously adaptive, socially empowering and self-enhancing' nature of scientific and technological literacy (1986, p.19). The knowledge-ownership-empowerment paradigm suggested by Hungerford and Volk (1990) implies the same meaning. In line with this broad view of science education, schools are encouraged to provide young people with real-world problems, equip them with essential skills – listening, arguing, making a case, accepting the greater wisdom or force of an alternative view – and then move to actions designed to resolve the problematic issues at hand. Yet how can young people learn how to make considered decisions about issues of a socio-scientific nature if their education in science and technology fails to provide them with the opportunity to practice the skills associated with argument by considering controversial issues (AAAS, 1993; Newton, 1999; NRC, 1996).

Several studies supported this broad and integrated STS approach in science education. Solomon (1992) reported that as a result of discussing controversial issues, students became more aware of their civic responsibility and more self-reliant in deciding on an issue. Hines et al. (1987) showed that citizens who had practiced on science and technology-related problematic societal issues were knowledgeable about the action that might be taken to resolve such issues; had the ability to carry out or take action needed for solving the problematic issues; and possessed certain personality and attitude characteristics that facilitated action. Similar results established through a decade of research in the USA, show that students' social responsibility is fostered by STS courses that involve them in real investigations of STS issues and attempts to resolve them (Ramsey, 1993; Rubba, 1990).

In broadening the scope of science education beyond the mere acquisition of scientific knowledge and habits of mind to include also the attainment of responsible modes of conduct, science education is empowered. When putting under scrutiny not only the validity of our knowledge, but also that of our beliefs, attitudes and values – the reasoned basis for our modes of conduct, we view science education as liberating and as contributing to the welfare of humans.

The Israeli experience, however, did not yield the promised outcomes. In spite of the success in enriching the participants of our two educational interventions with relevant information on the sources and consequences of the dispute over water resources and in spite of exercising decision-making in real relevant situations of scarce water management, only minor attitudinal change occurred in the desired directions and only a small percentage of participants changed their disposition to act or their predetermined decision in regard to sharing water resources with their Palestinian neighbors for the sake of peaceful coexistence.

We have been enthusiastic throughout our project and are still highly emotionally involved as educators in the attempt to do something for peace in our roles as science teachers. Using the tools of science for learning the roots and possible solutions for an acute societal and political problem in trying to change students as well as our own perceptions about the conflict over water resources in our region and being involved actively in striving for co-existence of the two societies in conflict, made this teaching experience much more worthwhile for us. Hence, we cannot but feel frustrated when we hit the limits of our educational endeavor. It seems to us that if we do not find a way to make people question the values that govern their thinking, making decisions and processing information, we will not be able to persuade and educate our students to coexist and responsible citizenry decision-making.

In spite of our frustration and disappointment, this teaching experience was very rewarding and motivating. We intend to continue with this mission now using the self-confrontational approach in value education, in hopes to be more successful in changing the attitudes and intentions to act of young students in Israel.

Notes

1. Assigning weights reflect a numerical value that represents how strongly the decision-maker prefers the outcome. For each outcome, its weight is multiplied by the probability of the proposition that the action would have that outcome and then summing them up and call the sum the action's expected utility.

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